

Salmonella in pork – Lessons to be learned from salmonella control in poultry

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Abstract

Based on Reg. (EC) No. 2160/2003, programs to control Salmonella in primary production in poultry have been decided and implemented in Europe. This paper addresses the question of the efficacy of these programs to reduce the incidence of salmonellosis in humans in Germany.

From the available data it becomes clear, that there is a strong reduction by 54 % of the annual salmonellosis incidence in humans from 2007 to 2010 that is mainly attributable to a reduction in cases of *S. Enteritidis* (-74 %), but also to a reduction in *S. Typhimurium* (-30 %). Data from the established control programs and from food surveillance at the same time indicate a reduction of positive herds, of positive samples of poultry meat and of the share of *S. Enteritidis* and *S. Typhimurium* among the Salmonella isolates from the positive food samples. Overall, this justifies the assumption that the implementation of the Salmonella control programs in poultry has been successful with respect to the aim of reducing human salmonellosis so far. This is encouraging for the discussion on reduction targets in pig production.

Introduction

Based on Reg. (EC) No. 2160/2003, the requirements for programs to control Salmonella in primary production in poultry have been fixed in specific regulations. All Member States had to implement these control programmes. Regulations to control Salmonella in primary production in poultry were released in several steps, starting with breeding flocks (Reg. (EC) No. 1003/2005), followed by laying hens (Reg. (EC) No. 1168/2006), broilers (Reg. (EC) No. 646/2007), and turkeys (Reg. (EC) No. 584/2008). At the same time, eggs from flocks of laying hens that were positive for certain Salmonella serovars were banned from being sold as category A eggs for human consumption (Reg. (EC) No. 1237/2007).

The regulation for laying hens fixes a flexible reduction target to combine public health needs (reduction in human salmonellosis cases) with highly variable baseline prevalences in the respective poultry population in the Member States identified during baseline studies. For breeding flocks, broilers and turkeys a target of one percent of the relevant serovars should be achieved. The control programs focus on serovars that have continuously been associated with high incidence rates in the human population: in Germany, *S. Enteritidis* is closely associated with *Gallus gallus*, especially laying hens, and *S. Typhimurium* is more prevalent in meat production lines of poultry and the predominant serovar in pigs. Baseline studies in breeding and finisher pigs have also been carried out in Europe. However, reduction targets have not yet been defined.

The incidence of salmonellosis in humans in Germany has decreased substantially over the last 20 years. While this looked like a continuous process, the decline has gained speed since the implementation of the new regulations on salmonella control in poultry. The relationship between these regulations and the sharp decrease in human salmonellosis is underlined by the even more prominent decrease in human salmonellosis due to *S. Enteritidis*, the predominant serovar in laying hens.

Unfortunately, poultry production and pig production differ in many aspects pre and post harvest. Therefore, a simple copy of the control programs in poultry will not be feasible.

Material and Methods

For layers, broilers and turkeys the results of the baseline studies (Käsbohrer et al. 2010) are compared to the results reported in the framework of the control programs.

Data from human infections were taken from the respective reports of Robert Koch-Institute for the years 2001 to 2009

and from the survstat system run by RKI for 2010 (data taken as per 06. May 2011). Datasets without reported serovars were attributed to the known serovars according to their share of the reported serovars.

Results

Results of the baseline studies are shown in figure 1. It is obvious that in layers most (80 %) of the reported positives were *S. Enteritidis*, while a limited proportion was *S. Typhimurium*. In contrast, in broilers and turkeys, most isolates were other serovars.

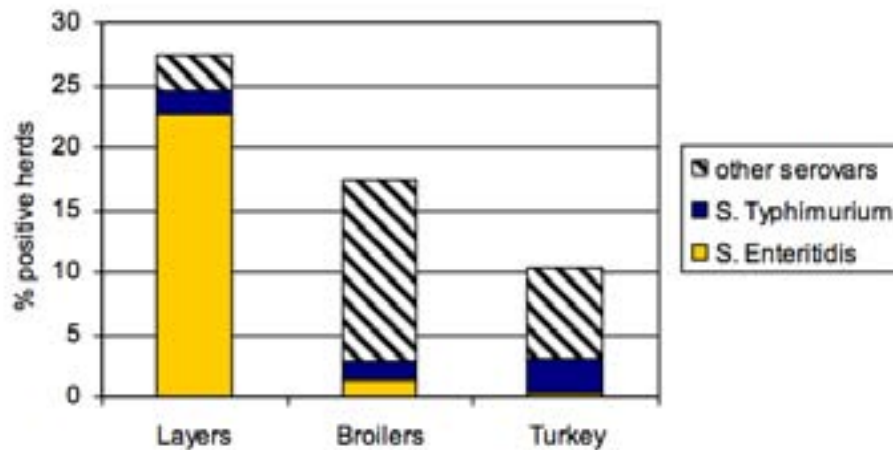


Fig 1: Proportion of positive flocks in Germany within the EU baseline studies on *Salmonella* in laying hens (2004/2005), broilers (2006/2007) and turkeys (2008).

In 2009, *S. Enteritidis* was still the predominant serovar in layers accounting for 4.5 of the 6.6 % positive herds reported (68 %) but the proportion of reported positive herds was far lower than in the baseline study. In broilers, in 2009, there were only 0.4 % of herds positive for *S. Enteritidis* and *S. Typhimurium*, i.e. the number was reduced by 86 %.

In broiler meat, between 2005 and 2008 the rate of positive samples collected in the framework of official food control was between 8.5% and 11.5% (Fig. 2). In 2009 it dropped to 6.2% and was at 6.6 % in 2010. In turkey meat, the rate was at 5.8 % in 2010 after considerable variation in previous years.

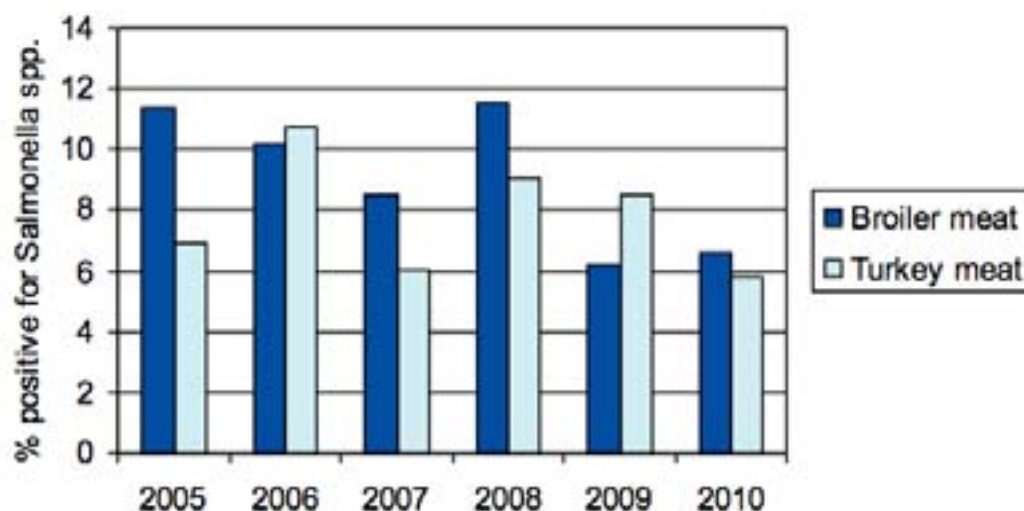


Fig. 2: Proportion of broiler and turkey meat samples collected within official food control and positive for *Salmonella* spp. between 2005 and 2010.

Among the *Salmonella* isolates from broiler meat the proportion of *S. Enteritidis* and *S. Typhimurium* dropped sharply from 2008 (19.5 and 13.8 %) to 2009 (5.2 and 3.4%). Data for 2010 are currently being generated.

The incidence of reported salmonellosis cases in humans has dramatically decreased by 54 % in Germany from 2007 to 2010 (Fig. 3). The decrease mainly involved the incidence of infections with *S. Enteritidis*, the predominant cause of salmonellosis in humans in the last decade. Infections with *S. Enteritidis* were reduced by 74% with a constant annual decrease of more than 30 % for the years 2007 to 2010. Infections with *S. Typhimurium* did not decrease to this extent. However, the overall decrease from 2007 to 2010 was 30% despite an increase from 2009 to 2010 (Fig. 4). In contrast, there was an overall dramatic increase of infections due to other *Salmonella* serovars from 2007 to 2008, followed by a decrease by from 2008 to 2010.

Discussion

It is tempting to attribute the constant decrease of *S. Enteritidis* infections in humans to the application of the regulations based on Reg. (EC) No. 2160/2003. *S. Enteritidis* infections in the past have mainly been attributed to products from *Gallus gallus*, i.e. eggs and broiler meat. The combinations of strict regulations on the level of primary production and on the trade of eggs probably contributed a lot to the decrease in *S. Enteritidis*.

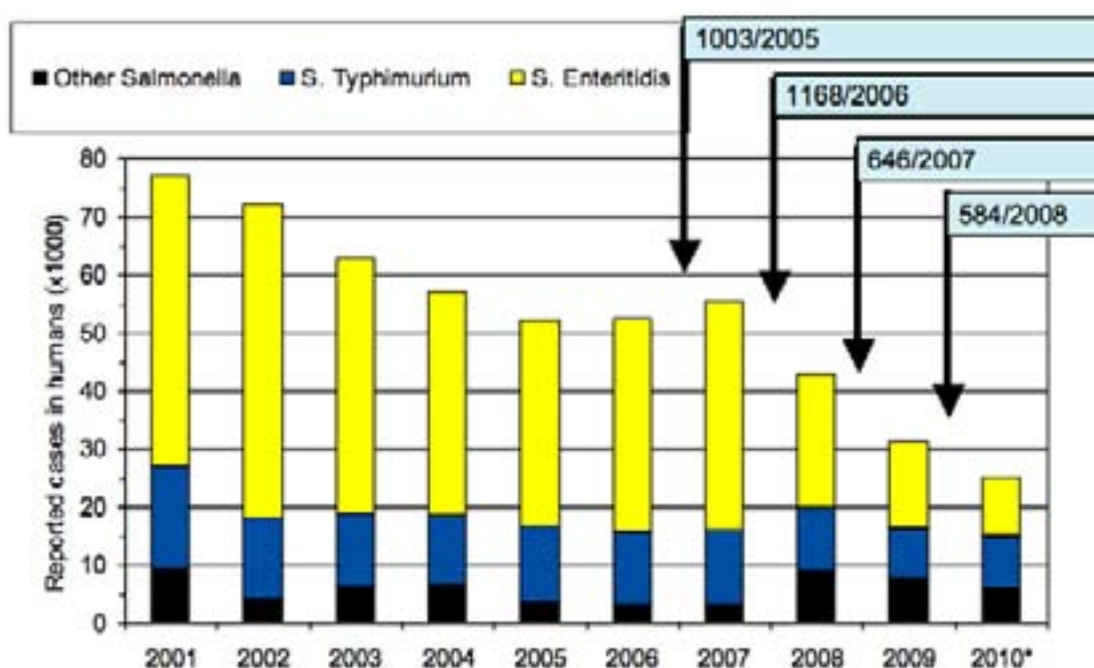


Fig. 3: Human cases reported to Robert Koch-Institute in Germany 2001 to 2010 and implementation of EU regulations of control of *Salmonella* in primary production in poultry. Arrows indicate beginning of control programs according to the respective EU-regulations.

Interestingly, *S. Typhimurium* also decreased from 2007 to 2010, however, to a lesser extent and not consistently. It is not clear, whether this reduction is due to the new regulations in place, as there was an actual increase in 2010 compared to 2009. Human infections with *S. Typhimurium* have been mainly attributed to contaminated meat and it could be expected that the decrease would not be observed before the regulations on broilers and turkeys were put in place. In line with a potential effect of the regulations, contamination rates of meat from broilers with *Salmonella* spp. were lower in 2009 and 2010 than in the years before. Moreover, the proportion of *S. Enteritidis* and *S. Typhimurium* among the positive samples sharply dropped. Likewise, in turkey meat rates were lower in 2010 than the average of 2005 to 2009. However, future surveillance programs will have to prove that this is a permanent effect.

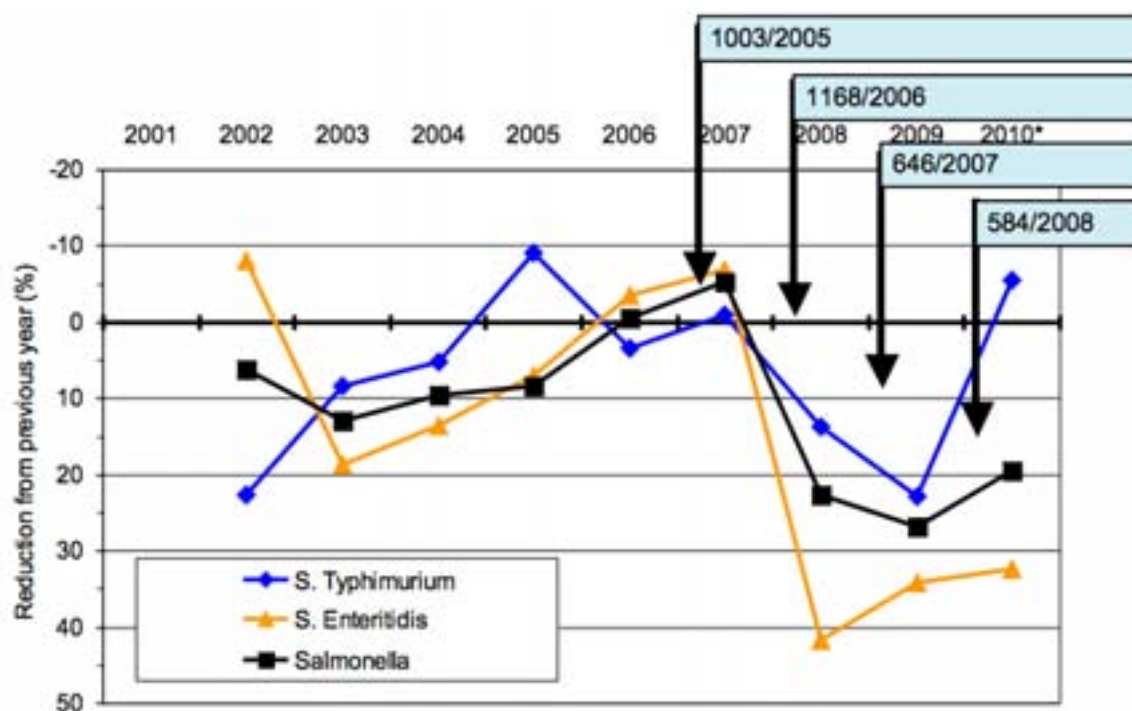


Fig. 4: Annual reduction of salmonellosis cases in humans based on data published by Robert Koch-Institute. Arrows indicate beginning of control programs according to the respective EU-regulations.

For controlling *Salmonella* in pigs, this is a challenge as infections with *S. Typhimurium* have been attributed to pig meat and control measures in pigs are expected to reduce the caseload of *S. Typhimurium* infections in humans.

Conclusion

The development of human cases of salmonellosis indicates that consistent measures to control salmonellosis in livestock can reduce the human burden of disease. This is encouraging for the setting of targets for *Salmonella* spp., especially *S. Typhimurium* in pigs. However, due to the differences in pig and poultry production, the procedures cannot be copied one by one but will have to be adapted to the specific situation.

References

Reports of Robert Koch-Institute on Salmonellosis in human in Germany are available online at:
http://www.rki.de/cln_160/nn_196882/DE/Content/Infekt/Jahrbuch/Jahrbuecher/jahrbuecher__node.html?__nnn=true
 current data can be accessed at: <http://www3.rki.de/SurvStat/>

Reports on *Salmonella* in meat in Germany are available online at:
http://www.bfr.bund.de/de/zoosenberichterstattung_durch_das_bfr-300.html

Käsbohrer, A., B.-A. Tenhagen, K. Heckenbach et al. 2010. Salmonellen beim Geflügel - Ausgangssituation für die amtlichen Bekämpfungsprogramme. Leipziger Blaue Hefte. Band 2, Leipziger Universitätsverlag GmbH, Leipzig, 274-278